RESmart™ CPAP System

Service Manual

Important

All data in this manual have been verified correctly. It is sufficient for servicing and repairing this device. If applying this manual on other purpose, the validation should be confirmed by BMC Medical Co. Other wise, BMC Medical Co. has no responsibility for the result. All information in this manual is protected by law and regulation. All copyrights are belongs to BMC Medical Co.

INPORTANT, CAUTION AND WARNING in this manual are to emphasize dangers to service people.

WARNING If do not operate properly, may cause damage to people and environment.

CAUTION If do not operate properly, may cause damage to instrument.

IMPORTANT Important information for servicing and repairing.

Safety Notice

Electric Shock

There is above 100VAC voltage inside this device, please be sure to repair device after power off.

Chemical Safety

There may be risk of virus after touching by patient. Please clean device or wear protective glove before servicing and repairing. Please deal with the waste according to regulation. Wash hands by disinfector after operating this device.

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1. Introduction

1.1 Intended Use

The RESmart system is a CPAP (Continuous Positive Airway Pressure) device designed for the treatment of adult Obstructive Sleep Apnea (OSA) only.

The RESmart is to be used only on the instruction of a licensed health care professional. Your home care provider will make the correct pressure settings according to your health care professional's prescription.

This device is not intended for life support.

This service manual is used to help service people maintenance RESmart™ CPAP system of BMC Medical Co. more efficiently. Instructions in this manual may help device work best.

Engineer can find needed instruction from this manual quickly.

IMPORTANT Read and understand instruction in this manual before operating.

IMPORTANT RESmart™ CPAP system can not be used for life support.

I.2 Implement

1. Implement for repairing

    Type '+' screw driver

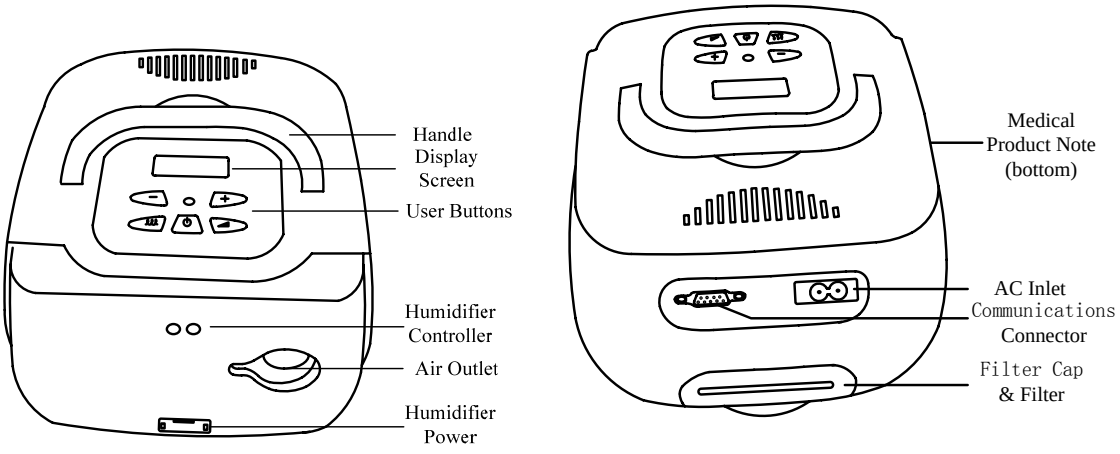
    Pincers

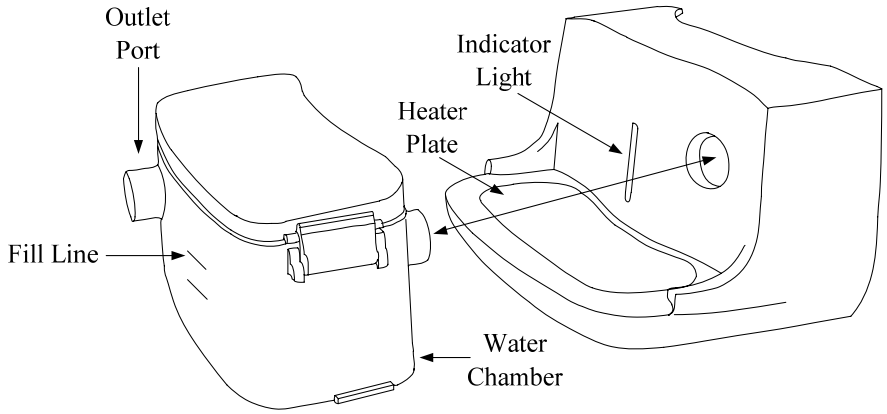
2. Implement for measuring

    Pressure meter

2. Structure

2.1 Outer Illumination





2.2 Inner Construction

See appendix A

2.3 Spare Part

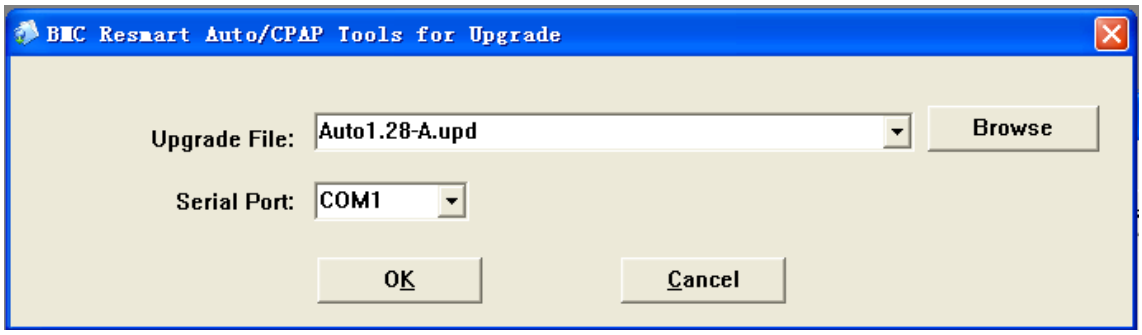
See appendix B

3. Software

3.1 Instruction for Upgrading Device Software

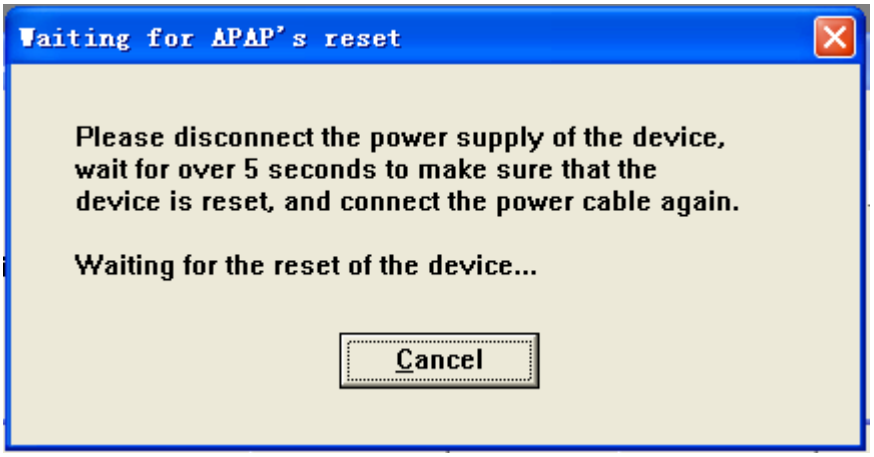
1. Power off the RESmart CPAP, then connect PC and the device via data cable.

2. Run the software “BMC RESmart Tools for Upgrade” from PC and display as below:



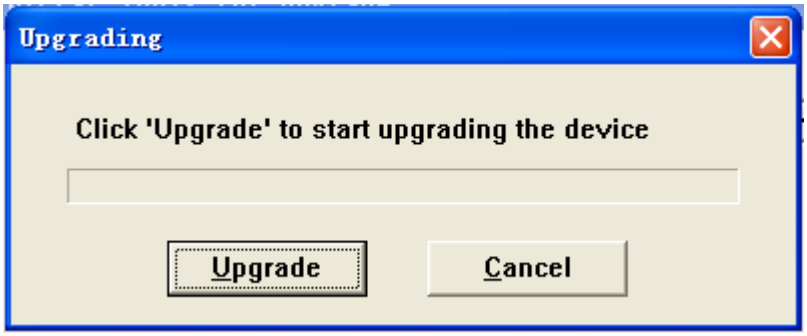
   a) Select the right Upgrade File (for example: version 1.28 for AutoCPAP is “Auto1.28-A.upd).
   b) Select the right serial port, default is COM1.

3. Click “OK”, display as below:


Waiting for APAP's reset
Please disconnect the power supply of the device,
wait for over 5 seconds to make sure that the
device is reset, and connect the power cable again.
Waiting for the reset of the device...
Cancel

   Power on the CPAP/AutoCPAP device. If the device is power on from beginning, please power off the device and turn on again after 5 seconds more.

4. After the device is turned on, the following will display:



Click “Upgrade” to start. If success, the right version number will be displayed on CPAP/AutoCPAP device screen when every power on.

Note: If failed during upgrading, please repeat from above 1-4 steps.

If “Error 08” displayed after software upgrading, it means unmatched software used (for example: apply AutoCPAP software to CPAP device). In this case, apply correct software and upgrade again.

3.2 Hidden Function

1. **Humidifier matching and dis-matching**
   (Available on version 1.40 and later)

   Assemble humidifier on main device, do not apply water tank. Enter maintenance menu, set ‘Ramp’=40, then press ‘Heated Humidifier’ button when ‘Init P’ appears. Thus the humidifier is matched. When ‘OK’ appears on LCD, humidifier matching successes.

   If cut the power supply after pressing ‘On/Off’ button when 'Init P’ appears, then the humidifier is dis-matched.

2. **Reset**
   (Available on version 1.29 and later)

   Enter maintenance menu, press ‘Ramp’ button for 5 seconds more, thus hidden date setting appears. Set ‘YYYY/MM/DD’=’2097/07/01’, press ‘On/Off’ when ‘Hour’ setting, thus all device setting and use time, use days are reset.

3. **Pressure calibration**
   (Available on version 1.20 and later)

   Connect pressure meter to the gas outlet in the device, enter hidden date setting, set ‘YYYY/MM/DD’=’2098/08/08’, press ‘On/Off’ when ‘Hour’ setting, thus pressure calibration starts. The

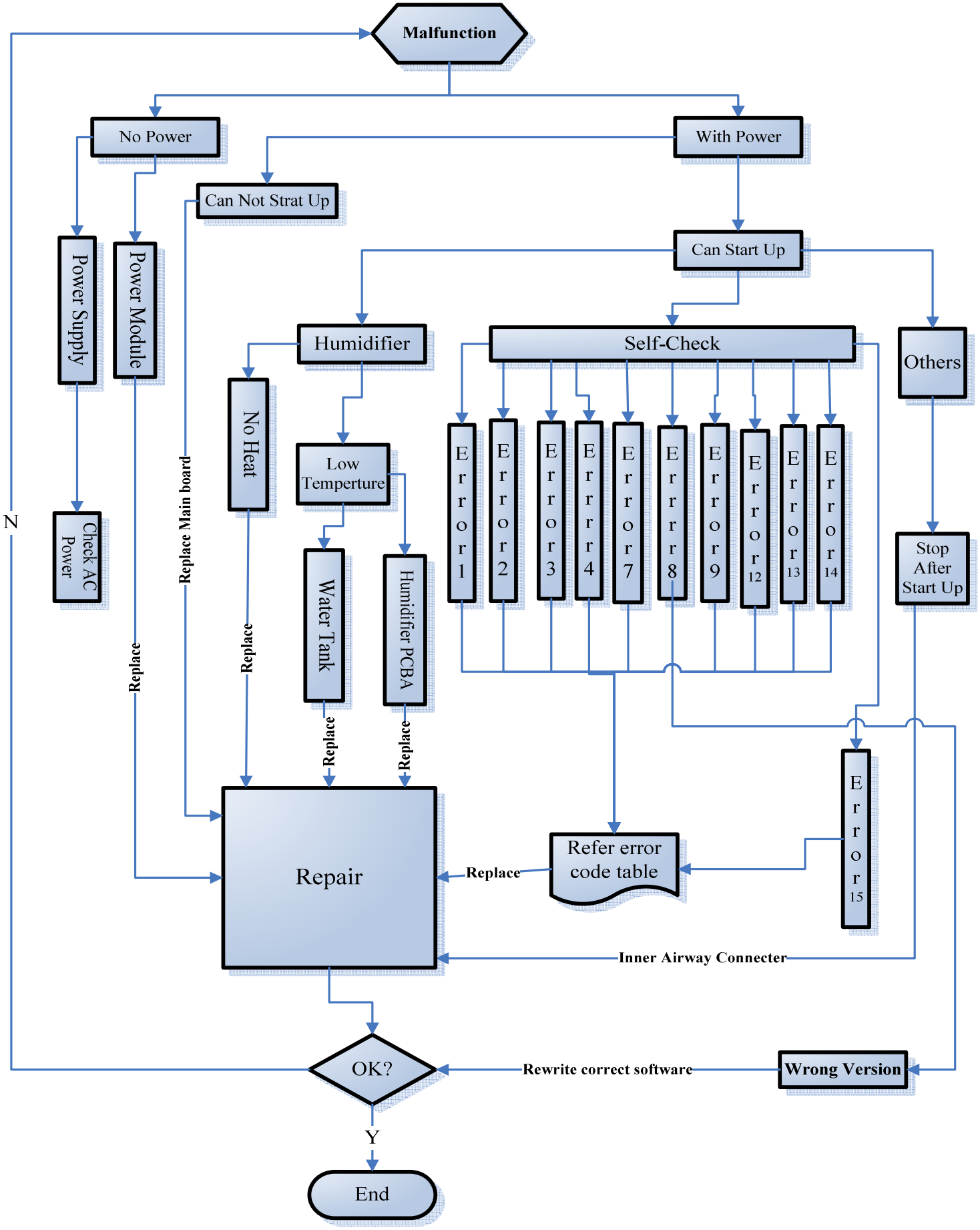
device increases pressure to 20hPa(cmH2O), AD sampling data will appear on LCD. When LCD data displaying is stable, if pressure meter value is not 20, press '+/-' button to adjust the pressure output. Until output pressure value is 20 and LCD displays stable, press 'On/Off' button to finish pressure calibration.

4. Malfunction and Countermeasure

4.1 Error Code Table and Information

Error Index	Problem	Causing
Error1	**Over temperature inside or Temperature sensor fault**	Malfunction on main board
Error2	Motor stop	**Malfunction on motor or main board**
Error3	Motor low speed	**Malfunction on motor or main board**
Error4	Low temperature inside	**Malfunction on main board**
Error7	Pressure sensor fault	**Malfunction on main board**
Error8	Wrong software version	software
Error9	Host parameter error	**Malfunction on main board**
Error12	Over temperature inside or digital pressure fault	Malfunction on main board
Error13	machine at temperature below o ℃ or digital pressure fault	Malfunction on main board
Error14	over motor temperature inside or motor temperature sensor fault	Malfunction on motor or Motor temperature sensor
Error15	motor temperature sensor fault	Malfunction on motor temperature sensor

4.2 Malfunction Determination



Appendices

Appendix A:

Device Configuration

1. Main device

Fig. A - Main board (backside)

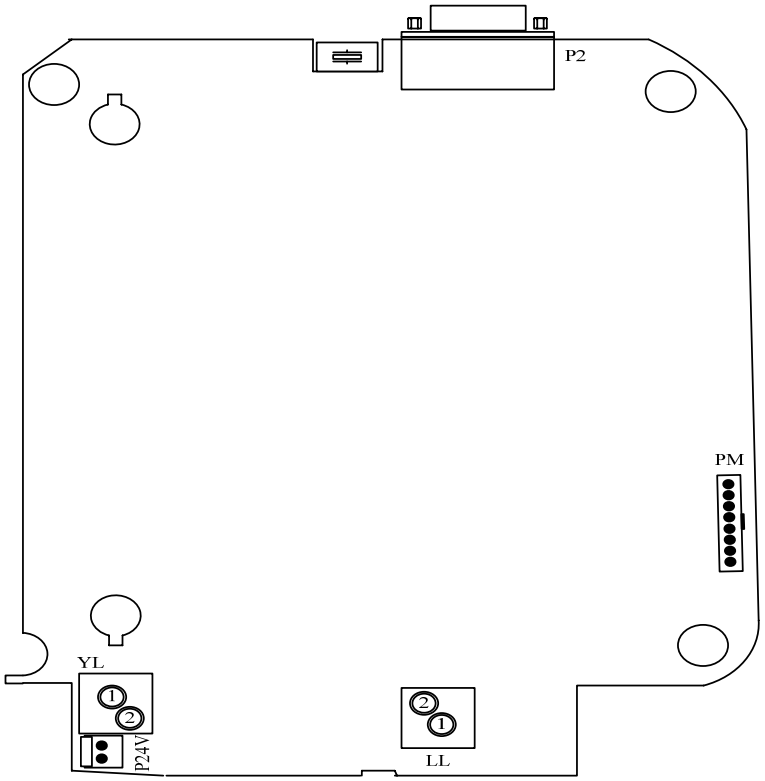
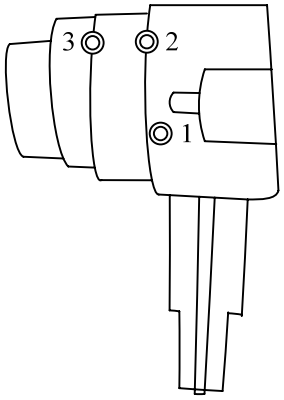


Fig. B – Outlet (leftside)



Hole #1 in Fig. B, connect to sensor YL via silicon rubber canal. Specified in Table 1:

Fig. B	Fig. A	Specification of canal
1	Hole #1 on sensor YL	ϕ2mm, Φ4mm, L12cm

Table 1

Fig. C – Power PCBA (front side)

Sockets figuration

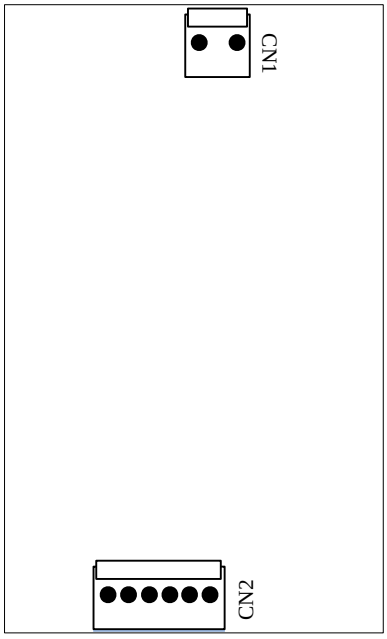


Fig. D – Wire connecting on power PCBA

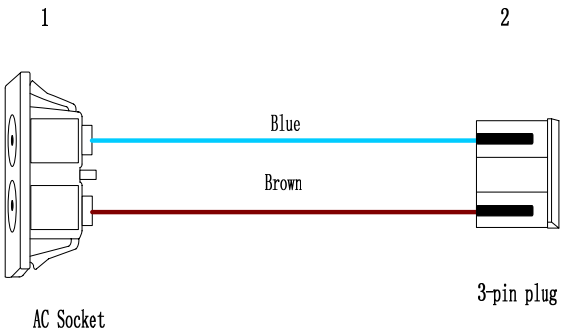


Fig. E – Power supply connecting

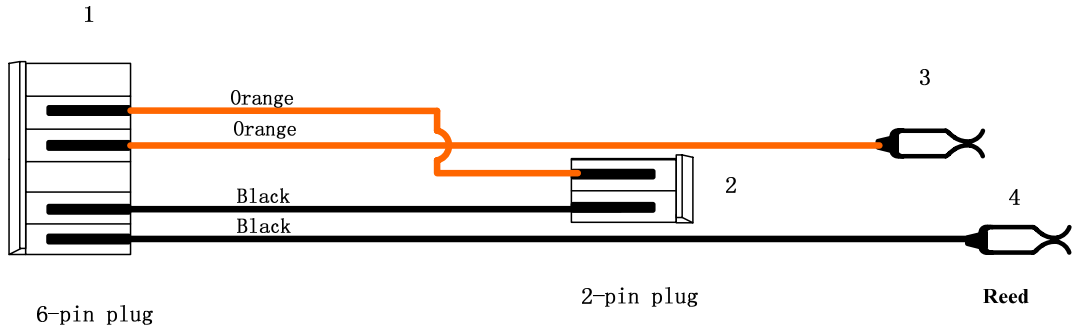
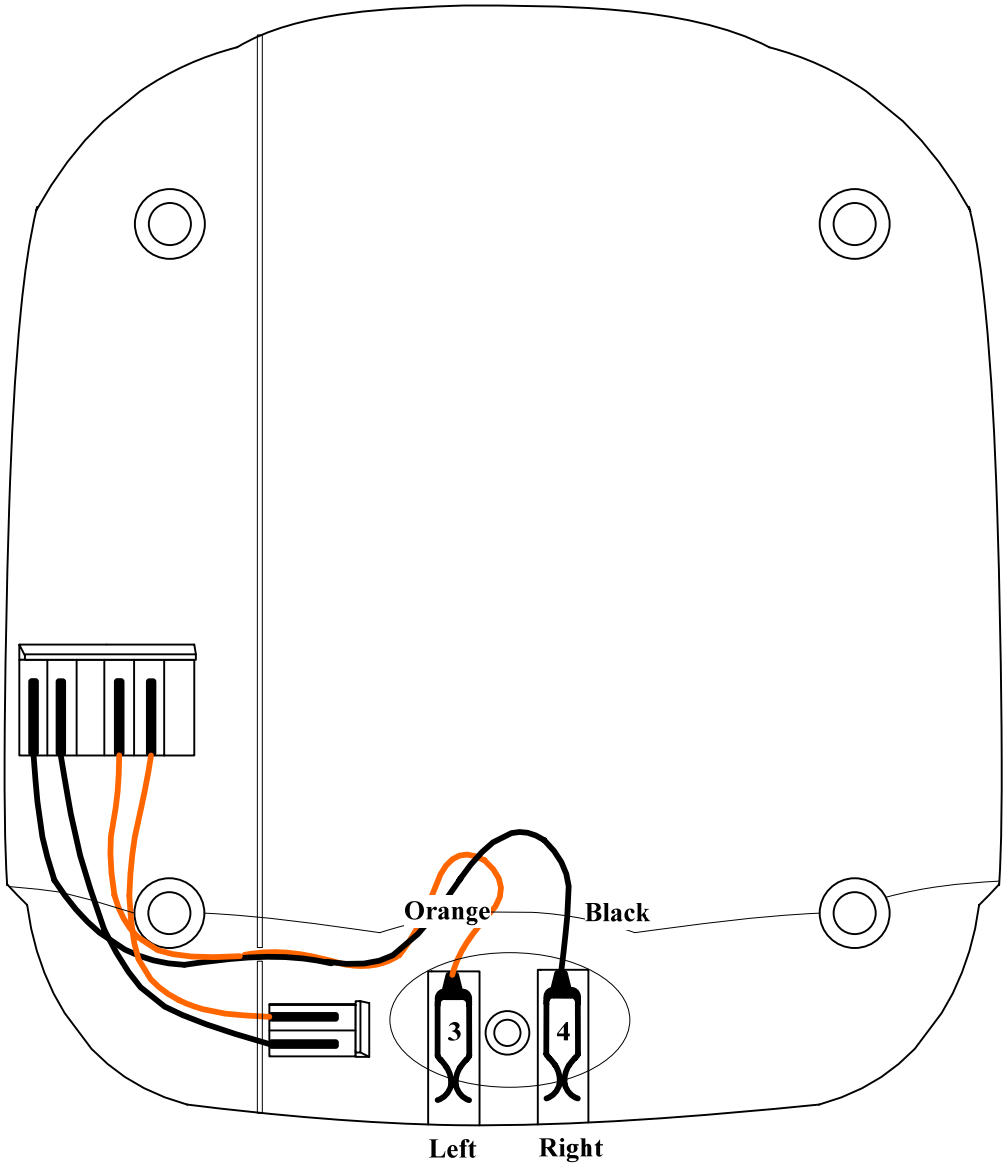


Fig. F – Power supply to humidifier



Connecting relationship:

Part / Fig.	1	2	3	4
D	Back of device	Fig. C: CN1		
E	Fig. C: CN2	Fig. A: P24	Fig. F: Left	Fig. F: Right
Blower 8-pin plug	Fig. A: PM			

Table 2

2. Humidifier

Fig. G – Humidifier PCBA (back side)

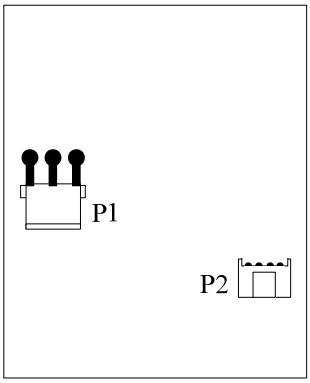


Fig. H – Power supply to humidifier

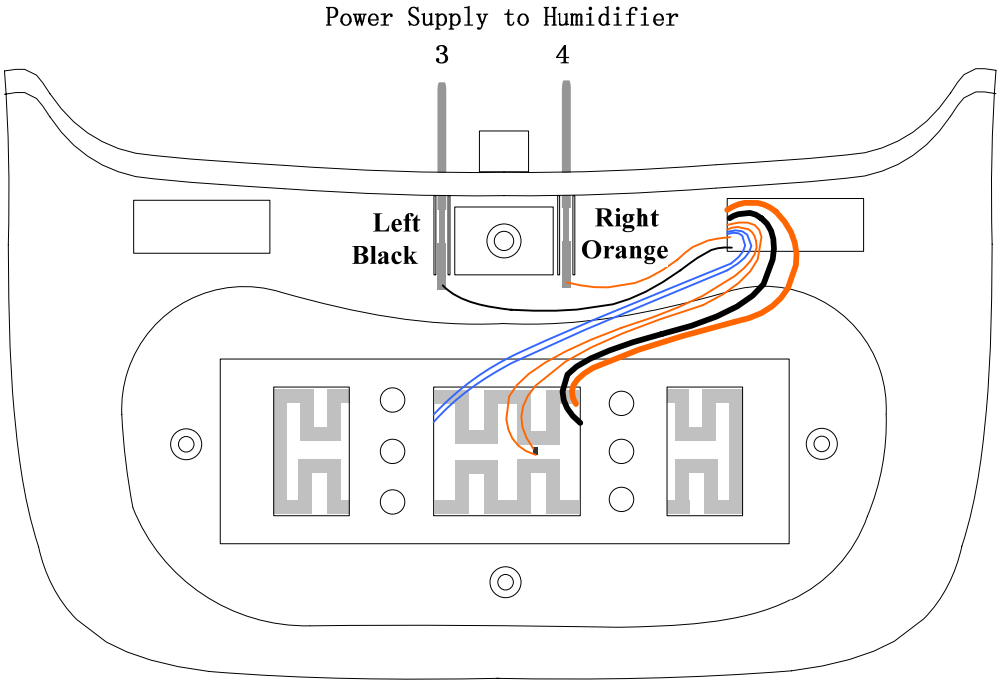
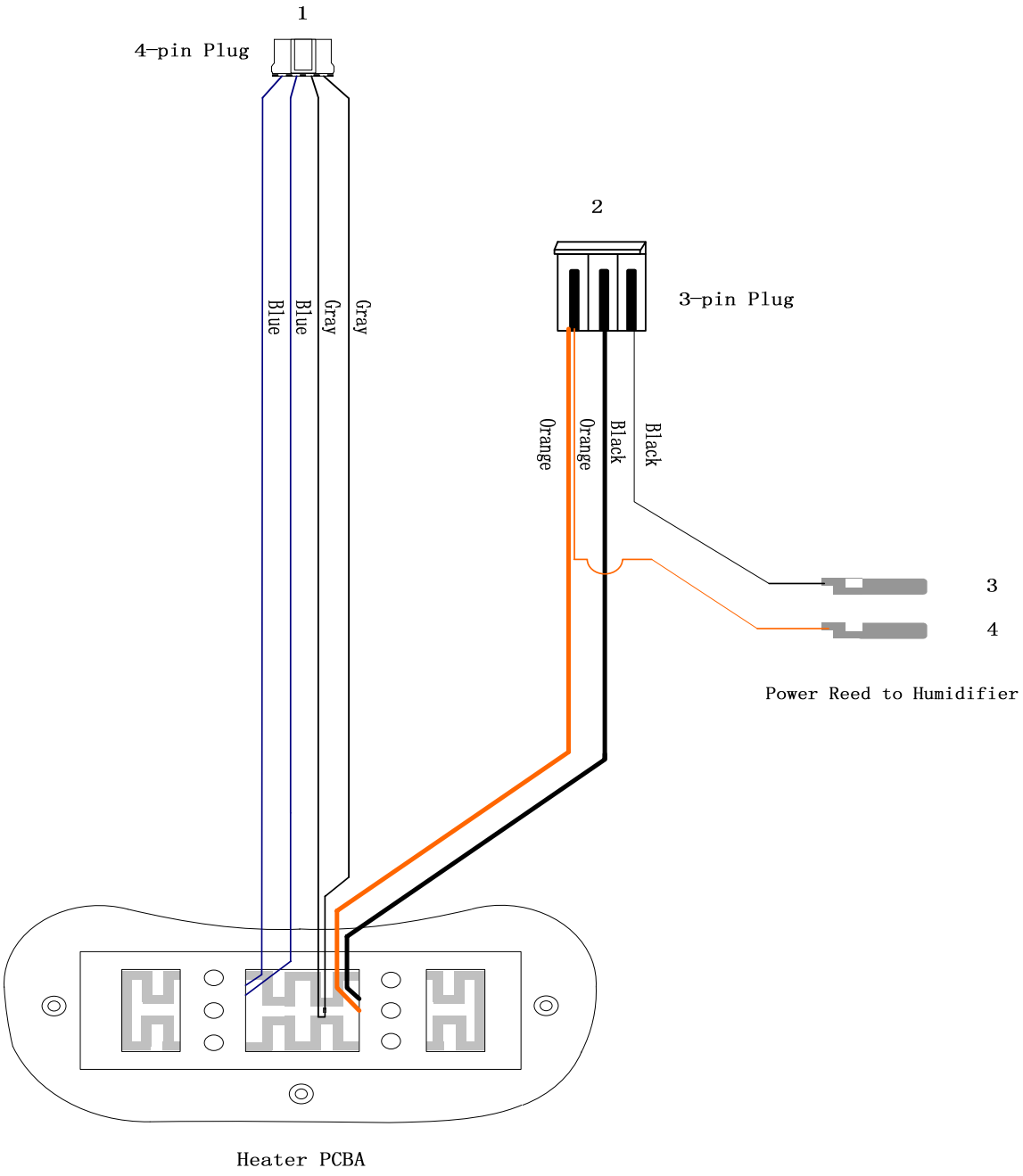


Fig. I – Heater PCBA



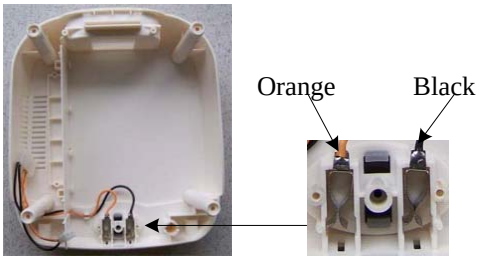
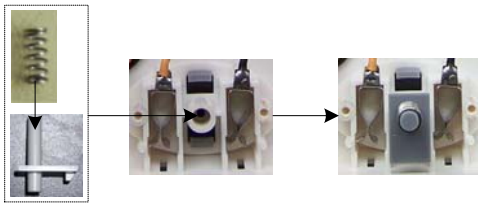
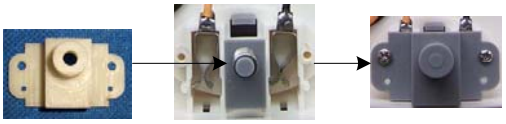
Connecting relationship:

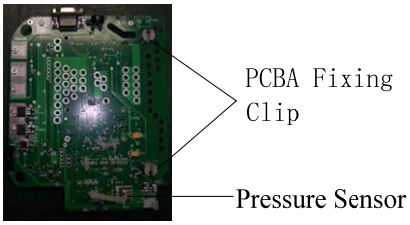
Part / Fig.	1	2	3	4
I	Fig. G: P2	Fig. G: P1	Fig. H: Left	Fig. H: Right

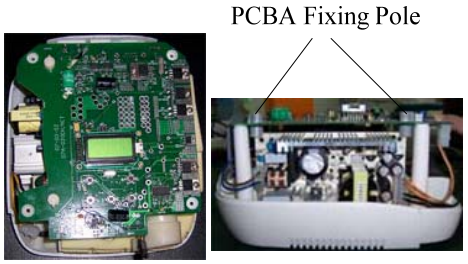
Table 3

Components Illumination

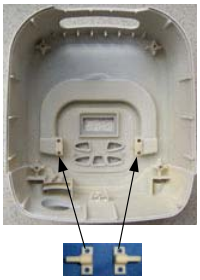
1. Device Inside

S/N	Assembly	Figure
1	Insert humidifier locker on the shield bottom.	
2	Insert humidifier power supply reed on the shield bottom as per Fig. E and F.	
3	Assembly the humidifier locker and button spring.	
4	Put fixing on the spring and fix by screw (2×3mm*8mm).	
5	Put power wire.	
6	Assembly the shield back on the bottom, fix by screw (2×3mm*8mm).	
7	Assembly foam (bottom) into shield bottom.	
8	Assembly AC power socket on the shield back (character face up).	

9	Clean up the wire.	
10	Assembly power PCBA in the socket and connect all plugs. Clean up the wire.	
11	Connect outlet to blower connector, fix by clip.	
12	Connect blower to connector and fix by clip. Put the integrated one in the right place.	
13	Covered by foam cover and clean up wires.	
14	Assembly fixing clip on the main board PCBA.	
15	Plug the 8-pin plug of blower in the socket PM plug #2 as in Fig. E in the socket P24 on the main board PCBA.	

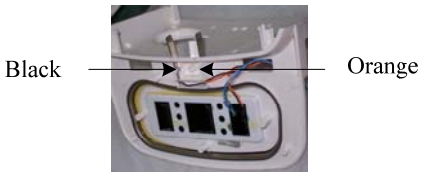
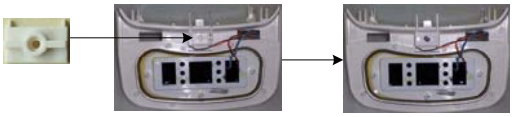
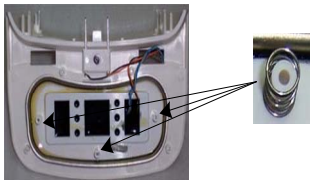
16	Assembly the main board PCBA on fixing pole and make sure the clip clamps power PCBA.	

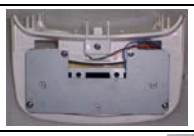
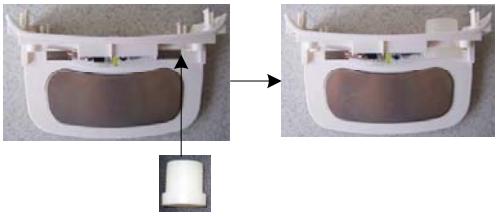
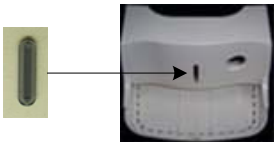
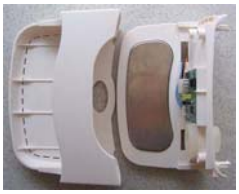
2. Device Outside

S/N	Assembly	Figure
18	Put handle in the socket on shield cover.	
19	Assembly handle fixing to handle and fix by screw (4×3mm*8mm).	
20	Assembly the infrared window.	
21	Assembly and fix the panel.	
23	Put on the key button.	

24	Assembly shield cover on the bottom, adjust the position of outlet and make sure it is clamped in the right socket.	
25	Fix the shield by screws (4×M3*10mm).	
26	Stick four device pads.	
27	Put in filter and assembly the cover.	
28	Put on all plugs if necessary (without humidifier).	

3. Humidifier

S/N	Assembly	Figure
1	As per Fig. H, assembly the heater plane and wire. Fix them by screw (3mm*8mm).	 
2	Put spring on each of three poles on heater plane.	

3	Assembly the scaleboard on the heater plane and fix by screw (3mm*8mm).	 Scaleboard
4	As per Table 3, assembly heater PCBA and wires.	
5	Put the humidifier inner connector on the shield.	
6	Put on light window.	
7	Assembly the inner and outer shield.	
8	Fix on screw (M3*10mm).	Screw

Appendix B:

Spare Part Configuration

S/N	Name	Qty	Figure
1	Shield Cover	1	
2	Handle	1	
3	Handle Fixing	2	
4	Shield Bottom	1	
5	Humidifier Clip	1	
6	Humidifier Locker	1	
7	Humidifier Fixing	1	
8	Filter Cover	1	
9	Shield Back	1	

10	Outlet	1	
11	PCBA Fixing	2	
12	Infrared Window	2	
13	Panel	1	
14	Humidifier Outer Shield	1	
15	Humidifier Inner Shield	1	
16	Light Window	1	
17	Pole Platelet	1	
18	Humidifier Power Plug	1	
19	Humidifier Plug (left-up)	1	
20	Humidifier Plug (left-down)	1	

21	Humidifier Plug (right-up)	1	
22	Humidifier Plug (right-down)	1	
23	Device Pad	6	
24	Blower Connector	1	
25	Humidifier Inner Connector	1	
26	Key Button	1	
27	Humidifier Scaleboard	1	
28	Heater Plane Spring	3	
29	Button Spring	1	

Spare Part List

Part Name	S/N	Qty	Unit	Classify	Use
Main Board PCBA	20211151	1	PC	PCBA	Main Device
Heater PCBA	20212-41	1	PC	PCBA	Humidifier
Power Supply PCBA	20311101	1	PC	PCBA	Main Device
Blower	40211	1	PC	Assembly	Main Device
Heater Plane	45010101	1	Set	Assembly	Humidifier
Power Supply PCBA Wire	45010201	1	Set	Wire	Main Device
Main Board PCBA Wire	45010301	1	Set	Wire	Main Device
Silicon Rubber Canal	50224	1	PC	Assembly	Main Device
Foam (bottom)	40191-0101	1	PC	Foam	Main Device
Foam (cover)	40191-0201	1	PC	Foam	Main Device
Shied Cover	4011110101	1	PC	Plastic	Main Device
Handle	4011130201	1	PC	Plastic	Main Device
Handle Fixing	40111-0301	2	PC	Plastic	Main Device
Shield Bottom	4011110401	1	PC	Plastic	Main Device
Humidifier Clip	4011130501	1	PC	Plastic	Main Device
Humidifier Locker	40111-0601	1	PC	Plastic	Main Device
Humidifier Fixing	40111-0701	1	PC	Plastic	Main Device
Filter Cover	4011130801	1	PC	Plastic	Main Device
Shield Back	4011130901	1	PC	Plastic	Main Device
Outlet	4011123001	1	Set	Plastic	Main Device
PCBA Fixing	40111-1301	2	PC	Plastic	Main Device
Infrared Window	4011101401	2	PC	Plastic	Main Device
Panel	4011210101	1	PC	Plastic	Main Device
Power Supply PCBA Fixing	40111-1601	1	PC	Plastic	Main Device
Humidifier Outer Shield	4011112201	1	PC	Plastic	Humidifier
Humidifier Inner Shield	4011112301	1	PC	Plastic	Humidifier
Pole Platelet	40111-2601	1	PC	Plastic	Humidifier
Light Window	4011142401	1	PC	Plastic	Humidifier
Button Spring	4013140101	1	PC	Metal	Main Device
Humidifier Scaleboard	4013130401	1	PC	Metal	Humidifier
Heater Plane Spring	4013140501	3	PC	Metal	Humidifier
Humidifier Power Plug	4012110101	1	PC	Rubber	Main Device
Humidifier Plug (left-up)	4012110201	1	PC	Rubber	Main Device
Humidifier Plug (left-down)	4012110301	1	PC	Rubber	Main Device
Humidifier Plug (right-up)	4012110401	1	PC	Rubber	Main Device
Humidifier Plug (right-down)	4012110501	1	PC	Rubber	Main Device
Device Pad	4012110601	6	PC	Rubber	All
Key Button	4012110701	1	PC	Rubber	Main Device
Blower Connector	4012110801	1	PC	Rubber	Main Device

Humidifier Inner Connector	4012110901	1	PC	Rubber	Humidifier
Screw-1		8	PC	Screw	All
Screw-2		9	PC	Screw	All
Sunk Screw		4	PC	Screw	Main Device
Filter		1	PC	Accessory	All
Power Cord	33011101	1	PC	Accessory	All
Water Tank	45010401	1	PC	Accessory	Humidifier